ENGINE AND CRANK HOUSING

The present invention relates to a housing assembly for an engine and crankcase and is concerned particularly, although not exclusively, with a housing assembly for a rotating cylinder valve engine and crankcase.

An example of a known rotating cylinder valve engine is described in the specification of PCT patent application no. PCT/GB97/01934 in the name of RCV Engines Limited. The engine casing and crankcase designs for such rotating cylinder engines have the two principle rotating components in separate casings. The housing comprises a cylinder jacket to house the cylinder, a crank carrier to house the crankshaft and a third casing component with two flanges at 90 degrees to each other. The third casing component is used to hold these two casings in their correct relative orientation.

The casing design for rotating cylinder engines has two main requirements. Firstly it must firmly locate and retain the two principle rotating components, the crankshaft and rotating cylinder, in their correct relative positions at 90 degrees to one another. Secondly it should allow for the assembly of the engine, that is allow the piston to be inserted into the rotating cylinder and then the rotating cylinder and crank gears to be meshed at the correct timing point.

According to a first aspect of the present invention there is provided a housing assembly for a rotating cylinder valve engine comprising a rotary cylinder and a crank assembly, the housing assembly comprising a first casing part and a second casing part each formed with a respective jointing face, the first casing part being formed with a tubular bore adapted to receive the rotary cylinder and being formed to partially house the crank assembly and the second casing part being formed to partially

house the crank assembly, the housing further comprising a tubular portion for housing bearing means for the crankshaft assembly, the tubular portion being defined by a semi-cylindrical section formed on the first casing part and a semi-cylindrical section formed on the second casing part, the arrangement being such that in the assembled state the respective jointing faces are in contact with each other apart from any gasket therebetween, the plane of the jointing faces being substantially perpendicular to the axis of rotation of the rotary cylinder, the tubular portion locating and retaining the bearing means for the crankshaft assembly.

Preferably, the arrangement is such that in the assembled state the axis of rotation of the crankshaft assembly is substantially aligned with the plane of the jointing faces.

Preferably, the jointing faces of the respective semi-cylindrical sections are substantially perpendicular to the axis of rotation of the rotary cylinder.

The arrangement is preferably such that together, the jointing faces of the respective semi-cylindrical sections forming the tubular portion are substantially in the same plane as the axis of rotation of the crankshaft assembly.

In a first embodiment of the present invention, in an assembled state the bearing means for the crankshaft assembly is preferably located between a bevelled gear of the crankshaft assembly and a distal end of a crankshaft of the crankshaft assembly.

The bearing means preferably comprises at least two bearing units.

Alternatively, in a second embodiment of the present invention, a crankshaft bevel gear is located between one of the bearing units and a distal end of a crankshaft of the crankshaft assembly. Preferably, one of the bearing units is located between a crank web and a crankshaft bevel gear such that said bearing unit is distant from the semi-cylindrical section formed on the first casing part. Preferably the bearing unit which is distant from the semi-cylindrical section on the first casing part is located and retained by a separate bearing clamping means.

Preferably, in the assembled state the first casing part houses the rotary valve features of the engine. Alternatively, the first casing part of the housing assembly comprises a third casing part connectable to the first casing portion, the third casing portion being adapted to house the rotary valve features of the engine. The rotary valve features of the engine may include an inlet port, an outlet port, an ignition port and an exhaust port.

In a third embodiment of the first aspect of the present invention the first casing part is formed with a flange that comprises the jointing face and the second casing part is formed with a flange that comprises the jointing face, the arrangement being such that in the assembled state the two flanges form means for mounting the engine.

Preferably, the two flanges are each formed with corresponding holes that are useable to mount the engine.

According to a second aspect of the present invention there is provided a method of assembling a rotating cylinder valve engine comprising a housing assembly according to the first aspect of the invention, the method comprising introducing a rotating cylinder into the tubular bore of first casing part; then inserting a piston and conrod assembly into the rotating cylinder; then placing the crankshaft assembly in the semi-

cylindrical section recess in the first casing part with a crankshaft gear meshed with a rotating cylinder gear at the correct timing point; and then fastening the second casing part to the first casing part to locate and retain the crankshaft bearings.

Alternatively, there is provided a method of assembling a rotating cylinder valve engine comprising a housing assembly according to the second aspect of the invention, the method comprising introducing the rotating cylinder into the tubular bore of the first casing part; then placing the crankshaft assembly the semi-cylindrical section recess in the second casing part; then fastening an inner bearing cap to the second casing part to locate and retain the inner crank bearing; then holding the crankshaft and rotating cylinder in position to ensure that when the gears mesh the engine will be correctly timed; then inserting the piston and conrod assembly into the rotating cylinder; then fastening the second casing part to the first casing part to locate and retain the remaining outer crankshaft bearings.

The invention may include any combination of the features or limitations referred to herein.

The present invention may be carried into practice in various ways, but three embodiments will now be described, by way of example only, with reference to the accompanying drawings in which:

Figure 1 shows an exploded view of an engine and crankcase assembly according to a first embodiment of the present invention;

Figure 2 shows a cross section of the engine and crankcase assembly, shown in Figure 1, in an assembled state; and

Figure 3 shows a cross section of an engine and crankcase assembly according to a second embodiment of the present invention.

Rotating cylinder valve engines are known to the skilled person in the art. Rotating cylinder valve engines generally comprise a rotating cylinder wall and a reciprocating piston the linear motion of the reciprocating piston is converted into the rotation of the cylinder wall. The rotation of the wall is utilised for the opening and closing of the inlet and outlet ports of the engine.

An example of a rotating cylinder valve engine is described in specification of PCT patent application no. PCT/GB97/01934 in the name of RCV Engines Limited. The specification describes a rotating cylinder engine for a model aircraft. However, the skilled person in the art will realise that the engine described in this document may be adapted for many different applications.

By way of explanation of the present invention there follows with reference to Figures 1 and 2 a procedure for manufacturing and assembling a rotating cylinder valve engine according to a first embodiment of the present invention.

A rotating cylinder valve engine 'A' comprises a combined housing 'B'. The combined housing 'B' comprises an upper casing part 1 and lower casing part 2.

The upper casing part 1 comprises an upper mounting flange 19 that is formed with a jointing face 'C' and the lower casing part 2 comprises a lower mounting flange 20 that is formed with a jointing face 'D'. In the assembled state the upper mounting flange 19 and the lower mounting flange 20 combine to form a full depth mounting lug.

The upper casing part 1 and lower casing part 2 are first machined to form their respective jointing faces. The upper casing part 1 and lower casing part 2 are then fastened together. A crankshaft bore 21 is then machined together with two outer crank bearing locating grooves 22. The upper casing part 1 and lower casing part 2 are then disassembled and a rotary cylinder bore 15 machined in the upper casing part 1. Rotary valve features 14 are then machined into the upper casing part 1. A rotary cylinder bearing 12 is then pressed into the upper casing part 1. A rotary cylinder 4 is then assembled into the rotary cylinder bearing 12 and rotary cylinder bore 15.

A crankshaft assembly is then assembled by assembling a crank pinion 13, a crank pinion key 17, an inner crank bearing 7, a crank bearing spacer 6, two outer crank bearing locating rings 8, an outer crank bearing 5, a collet 10 and a prop driver 9 onto the crankshaft 3. A piston conrod assembly 11 is then assembled onto the crankshaft 3 and held in place by a circlip 25.

A piston is now introduced into the bore of the rotary cylinder 4, and the crank shaft assembly laid in an upper semi-cylindrical recess 23 in the upper casing part 1 with the crank pinion 13 meshing with the rotary cylinder 4 at the correctly timed point, and the outer crank bearing locating rings 8 inserted in the respective outer crank bearing locating grooves 22.

The lower casing part 2 is now fastened to the upper casing part 1 using six bolts 18. It will be appreciated that the upper mounting flange 19 and lower mounting flange 20 combine to form a full depth mounting lug.

With reference to Figure 3 the following is a procedure for manufacturing and assembling a rotating cylinder valve engine according

to a second embodiment of the present invention, wherein the inner crank bearing 7 is situated between the crank pinion 13 and crank web 24.

The upper casing part 1 and lower casing part 2 are first machined to form their respective jointing faces. The inner crank bearing cap 16 is then suitably machined and fastened to the lower casing part 2. The upper casing part 1 and lower casing part 2 are then fastened together. The crankshaft bore 21 is then machined together with the two outer crank bearing locating grooves 22. During this operation the inner bore of the inner crank bearing cap 16 will be machined to the correct tolerance to accept the inner crank bearing 7.

The upper casing part 1, lower casing part 2 and inner crank bearing cap 16 are then disassembled and the rotary cylinder bore 15 machined in the upper casing part 1. The rotary valve features 14 are then machined into the upper casing part 1. The rotary cylinder bearing 12 is then pressed into the upper casing part 1. The rotary cylinder 4 is then assembled into the rotary cylinder bearing 12 and rotary cylinder bore 15.

The crankshaft assembly is then assembled by assembling the inner crank bearing 7, the inner crank bearing spacer 26, the crank pinion 13, the crank pinion key 17, the crank bearing spacer 6, the outer crank bearing locating rings 8, the outer crank bearing 5, collet 10 and the prop driver 9 onto the crankshaft 3. The piston conrod assembly 11 is then assembled onto the crankshaft 3 and held in place by a circlip 25.

The crank shaft assembly is now laid in the lower semi-cylindrical recess 27 in the lower casing 2 with the outer crank bearing locating rings 8 inserted in the outer crank bearing locating grooves. The inner crank bearing cap is then fastened to the lower casing 2 to clamp the inner crank bearing 7 in position.

The piston is now introduced into the bore of the rotary cylinder 4, and with the crank pinion 13 meshing with the rotary cylinder 4 at the correctly timed point, the lower and upper casings are brought together. The lower casing part 2 is now fastened to the upper casing part 1 using the bolts 18. A gasket may be provided between the lower and upper casings.

The skilled person in the art will appreciate that the present invention provides a new design of housing which only requires two main casing parts, therefore reducing the complexity and cost of a rotating cylinder valve engine design and construction.